nitride film 105 by using the heating work and the electron beam irradiation work, as in the fifth embodiment described previously, and a semiconductor device 109 is formed.

After the polymethyl siloxane film had been formed as the interlayer insulation film 106 described above, when the obtained semiconductor device 109 is observed by using an optical microscope, the oxidization of the surface of the Cu wire 104 is not observed.

In addition, while each of the steps had been executed and after each of the steps has been completed, the release of the barrier metal 103, Cu wire 104, silicon nitride film 105, and interlayer insulation film 106 (polymethyl siloxane film) is not observed. In addition, when the resistance value of the Cu wire 104 is measured, the measurements were equal to each other before and after forming the interlayer insulation film 106. Further, when the CMP technique is applied to the polymethyl siloxane film, the release of the film did not occur.

According to the present embodiment, the polymethyl siloxane film is formed as the base insulation film 102 by using the heating work and the electron beam irradiation in combination, whereby a polymethyl siloxane with its relative dielectric constant lower than that according to the sixth embodiment can be formed. In this manner, the wiring

capacity of the semiconductor device 109 can be further reduced, and a product between a wiring resistance and an inter-wire capacity can be reduced more significantly. As a result, an operating speed of the semiconductor device 109 and those of various devices using the semiconductor device 109 can be improved more remarkably.

In addition, according to the present embodiment, the polymethyl siloxane film is formed as the base insulation film 102 by using the heating work and the electron beam irradiation in combination, wherein the above polymethyl siloxane and the semiconductor device 109 including the polymethyl siloxane film can be formed within a short period of time. Therefore, the productivity of the semiconductor device 109 and various devices using the semiconductor device 109 can be improved.

As has been described above, a method for manufacturing a semiconductor device according to the fifth to seventh embodiments each relates to a method for manufacturing a semiconductor device having a Cu wire. In particular, this method contains the step of forming an interlayer insulation film with its low dielectric rate for carrying out the electron beam irradiation. Therefore, the method for manufacturing a semiconductor insulation film according to the fifth to seventh embodiments each can be referred to as Cu

integration caused by an EB cured SOG film. Further at least one parameter can be changed as the first embodiment and similar effects can be attained.

(Eighth Embodiment)

According to research made by the Inventor et al, as in the above embodiments, it is found that, when light is externally applied, the polymethyl siloxane film formed by combining the heating and the electron beam irradiation processes emits fluorescence. This is because the heating work and the electron beam irradiation work are carried out at the same time, whereby C-C bonding that can be seen in a structure of an organic resin film can be formed in the polymethyl siloxane film.

In the present embodiment, a description will be given with respect to a method for evaluating the uniformity of in-plane curing of the polymethyl siloxane film by utilizing properties of such polymethyl siloxane film.

First, the steps 1 to 4 of the first embodiment are executed, and a polymethyl siloxane film of 1 micron in thickness is formed. The film forming conditions are the same except that the electron beam energy in the step 4 is 6 keV.

Next, Ar^+ laser of 514.5 nm are irradiated to 94 parts on the polymethyl siloxane film. At this time, the intensities of fluorescence emitted from the above